

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

WETLAND RESTORATION

(acre)

CODE 657

Definition

The rehabilitation of a degraded wetland or the reestablishment of a wetland so that soils, hydrology, vegetative community, and habitat are a close approximation of the original natural condition that existed prior to modification to the extent practicable.

Purpose

To restore wetland function, value, habitat, diversity, and capacity to a close approximation of the pre-disturbance by:

- Restoring hydric soil
- Restoring hydrology (depth duration and season of inundation, and/or duration and season of soil saturation).
- Restoring native vegetation (including the removal of undesired species, and/or seeding or planting of desired species).

Conditions Where Practice Applies

This practice applies only to natural wetland sites with hydric soils, or problem soils that are hydric, which have been subject to hydrologic or vegetative degradation, or to sites where hydric soils are covered by fill, sediment, or other deposits.

This practice is applicable only where the natural hydrologic conditions, including the hydroperiods, can be approximated by modifying drainage and/or by artificial flooding of a duration and frequency similar to the original, natural conditions.

This practice applies only to sites that were natural wetlands and where wetland functions and values have been diminished

or destroyed by soils, hydrologic or vegetative modifications.

This practice is applicable only where natural wetland functions and values can be restored to approximately the original condition by modification of existing soils, hydrology, or vegetation; or where elimination of current uses or management practices will permit the wetland to return to its original state.

Upon completion of the restoration the site will meet the current NRCS **wetland criteria as defined in the current National Food Security Act Manual** and habitat conditions of the wetland that previously existed on the site to the extent practicable.

This practice does not apply:

- to treat point and non-point sources of water pollution (Constructed Wetland - 656);
- to modify an existing wetland where specific attributes are heightened by management objectives, and/or returning a degraded wetland back to a wetland but to a different type than what previously existed on the site (Wetland Enhancement - 659);
- to creating a wetland on a site location which historically was not a wetland (Wetland Creation - 658).

GENERAL CRITERIA

The purpose, goals and objectives of the restoration shall be clearly outlined, including soils, hydrology and vegetation criteria that are to be met and are appropriate for the site and the project purposes.

**NRCS, NHCP
August 2005**

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#) or visit the [electronic Field Office Technical Guide](#).

**NRCS, WV
January 2006**

The soil, hydrology and vegetative characteristics existing on the site and the contributing watershed shall be documented before restoration of the site begins.

The nutrient and pesticide tolerance of the species planned shall be considered where known nutrient and pesticide contamination exists.

Where offsite drainage or the presence of invasive species impact the site, the design shall compensate for these landscape changes (e.g., increased water depth, berms or microtopography).

Sites suspected of containing hazardous waste shall be tested to identify appropriate remedial measures. Sites containing hazardous material shall be cleaned prior to the installation of this practice.

Invasive species, federal/state listed noxious plant species, and nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) shall be controlled on the site. This includes the manipulation of water levels to control unwanted vegetation. The establishment and/or use of non-native plant species shall be discouraged where possible.

NRCS National Engineering Handbook, Part 650, Engineering Field Handbook Chapter 13, "Wetland Restoration, Enhancement, or Creation" will be utilized in planning, designing and installing restoration measures.

Assistance may be obtained from NRCS biologists and/or soil scientists and engineers trained in, and knowledgeable of wetland criteria, as well as US Fish and Wildlife Service personnel as appropriate.

All necessary local, state, and federal permits shall be obtained prior to restoration.

Permits and/or notification may include the following:

- 1. U. S. Army Corps of Engineers (Section 404 Clean Water Act)***
- 2. WVDEP (Section 401 Clean Water Act & Sediment and Erosion Control Act)***

3. WV Public Lands Corp. (In-stream activities)

The original functions of the wetland will be identified and documented in order to establish the objectives and purpose of the wetland restoration. Restoration will provide for re-establishment of as many of the functions listed in NEH Part 650 as practicable.

The soils, hydrology and vegetative characteristics existing on the site and the contributing watershed shall be documented before restoration of the site begins.

Soils at the site will be evaluated for their ability to hold or retain water, underlying materials, depth, and suitability. Existing hydric soils, soils with hydric inclusions, and soils that were hydric before modification of the wetland will be identified. Boundaries of these soils will be marked in the field and located on the site plan map. Existing water table depths or indicators of seasonal high water tables will be documented.

Site topography will be evaluated for feasibility of construction of structures necessary for restoring wetland hydrology. Existence, location and elevation of neighboring properties and utilities will be documented. Presence, types and extent of all artificial drainage measures will be identified and evaluated. Restoration activities will be performed without impact to neighboring properties and utilities.

The work associated with the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit.

To the extent technically feasible reestablish topographic relief and/or microtopography. Use reference sites within the area to determine desired topographic relief.

The existing wetland hydrology or potential wetland hydrology will be identified and evaluated for adequacy in maintaining the wetland. Hydrologic regimes will be classified as inundated (flooded or ponded) saturated or combinations of both.

Existing vegetative communities on and surrounding the site will be identified and documented on the site plan map.

Where movement of sediment, sediment-attached substances and soluble substances carried by runoff will adversely affect the wetland, vegetative buffers will be established. Buffers will be established in accordance with WV practice standards Riparian Forest Buffer (391), Filter Strip (393), Riparian Herbaceous Cover (390) or other appropriate standards.

Where applicable, establishment of vegetation on disturbed areas outside the limits of the wetland shall conform to WV Conservation Practice Standards Riparian Forest Buffer (391), Critical Area Planting (342), Tree/Shrub Establishment (612), Pasture and Hay Planting (512) as appropriate. This buffer vegetation will be compatible with the planned functions of the wetland.

Barriers designed and installed according to WV Conservation Practice Standards Use Exclusion (472), or Fence (382), will be provided to protect the wetland when livestock have access to the area. In some cases, fences or other exclusionary techniques may be the only item necessary for restoration of natural wetlands that have been degraded by livestock.

If excessive nutrient, sediment or chemical loads have degraded wetland functions and values, plans for restoration will include measures to protect vegetation and storage volume. These measures may include watershed treatment in the form of nutrient and pesticide management, critical area treatment or similar practices. Other measures such as diverting polluted runoff, installing grassed filter strips and construction of sediment basins may also be required.

Where wildlife habitat is identified as a primary function of the proposed wetland restoration, designs will be prepared with consideration of management requirements developed according to WV Conservation Practice Standard Wetland Wildlife Habitat Management (644). The US Fish and Wildlife Service, Waterfowl Management

Handbook will also provide guidance in developing management plans, and appropriate designs, when waterfowl management is planned.

Criteria for Hydric Soil Restoration

Restoration sites will be located where the soils, in there original natural state, were hydric.

Where original soil is covered by fill, sediment, spoil, or other depositional substances, the material covering the original (hydric) soil shall be removed only to the surface of the buried original (hydric) soil. Excess material will be removed and placed on upland sites.

Restoration of hydric soils shall include sites where the original soil profile has been physically altered by the addition of materials to change the pH, redox potential, plasticity, permeability or percentage of sand, silt and clay. Also, restoration may include areas where the original soil has been excavated for off-site utilization (e.g. excavation of marl for agricultural use)

Restoration of these sites could include removal of the affected soil horizon(s), replacement of soil, addition of soil amendments or other physical modifications. When using replacement fill, the new material must match as closely as possible to the original soil series that existed on site prior to modification. If the original soil type is not known or is not feasible to attain, the new depositional material must be capable of developing hydric conditions and supporting hydrophytic vegetation.

An approximation of the original soil microtopography shall be attempted in all restoration activities.

Criteria for Wetland Hydrology Restoration

The hydrology (including the timing of inflow and outflow, duration, and frequency) and hydroperiod of the restored site shall approximate the conditions that existed before alteration. This includes affects to hydrology restoration caused by roads, ditches, drains, terraces, etc. within the watershed.

Excavations from within the wetland shall remove sediment to approximate the original topography and/or microtopography or establish a water level that will compensate for the sediment that remains.

A water supply **shall** be available approximating the needs of the wetland **functions**. A natural water supply should be used to reestablish the site's hydrology that approximates the needs of the wetland type. If this is not possible, an artificial water supply can be used; however, these sources shall not be diverted from other wetland resources.

The maximum hydrology and the overall hydraulic variability of the restored site will approximate the conditions that existed before alteration, e.g., dynamic and static water levels, soil saturation.

The effects on adjacent lands by any measures installed or modified to create wetland hydrology will be evaluated. Appropriate alternative actions will be necessary to offset any impacts.

NEH part 650, Engineering Field Handbook, Chapter 2, Runoff; Chapter 13, Wetland Restoration, Enhancement or Creation; Chapter 14, Drainage; and Chapter 19, Hydrology Tools for Wetland Determination will aid in evaluating the scope and effects of previous drainage and the planned restored hydrology of the site.

Appropriate component practices such as Dike (356), Pond (378), Dam, Diversion (348), Diversion (362), Grade Stabilization Structure (410), Grassed Waterway (412), Lined Waterway or Outlet (468), Pond Sealing or Lining (521), Pumping Plant for Water Control (533), Regulating Water in Drainage Systems (554), Water Harvesting Catchment (636), and Structure for Water Control (587) may be used as appropriate. Refer to the NEH part 650 Engineering Field Handbook for additional design information.

Where impoundments or other storage structures intercept water above the site, restoration plans will include modification of the impounding structures to permit passage of a sufficient volume of water at the proper times; removal of the structures;

or diversion of additional water from other sources.

In instances where fill or sediment deposition in depressional areas exist on a site in a manner that raises the ground surface above the level of surface or ground water that would normally support wetland conditions, restoration may involve removal of fill or sediment deposits and disposal on upland areas; or installation of structures that would raise the water level to an elevation where wetland conditions exist. Where the fill material will not support wetland conditions it will be removed from the site.

Where upstream sediment sources are not, or cannot be stabilized, restoration of the wetland may not be feasible. Sediment basins or other sediment traps will be necessary when sediment sources cannot be stabilized and restoration activities are to be accomplished.

Where constructed channels or ditches intercept or move surface water from drainage areas above the wetland, around or through the wetland, restoration may consist of filling interception ditches so upstream flows are distributed over the wetland area; filling channels through the wetland; or constructing impoundments in channels to restrict flow from the wetland.

In areas where surface drainage ditches or subsurface drain lines remove water on the surface of the wetland, or groundwater, from the site (i.e. random or pattern drainage systems that drain groundwater, direct precipitation, or water from depressional areas in floodplains of larger streams) the restoration may involve modifying or removing portions of the surface or subsurface drains. Restoration may also involve installation of channel blocks (impoundments) in existing surface drainage ditches.

Multiple hydrologic alterations may exist on a particular site. Therefore, a combination of the methods described above may be required to restore the site hydrologically.

Channel Modifications:

Required channel modifications will be designed and constructed in a manner that will result in a stable channel and such that the scope and effect of the resulting channel will not be detrimental to the wetland hydrology.

Impoundments:

Impoundments needed for restoration will be designed and constructed in accordance with WV Conservation Practice Standard Pond (378); unless the impoundment meets the definition of a "Channel Block" as described in this standard.

Ponds constructed in the floodplain of an adjacent watershed will be designed to be stable under flood flow conditions of the adjacent stream. They will also be constructed such that they do not create a restriction in the flow of the adjacent stream that may cause off-site damages.

If the adjacent stream will overtop the pond during a 25yr - 24hr flood or from a storm of equal frequency to the ESW design storm for the pond, whichever is greater, then the drainage area of the adjacent stream will be considered in designing the pond and spillways; unless the overtopping will cause no damage to the pond fill and spillways.

The drainage area of adjacent streams will not need to be considered in the design of the pond fill and spillways when the normal drainage area for the pond is less than 20 ac. and when the water surface elevation for the adjacent stream, at the outlet of the emergency spillway of the pond, is one foot or less below the ESW crest elevation at the time flow from the adjacent stream begins to overtop and flow into the pond.

Channel Blocks:

Channel Blocks are earth impoundments installed in an existing man-made surface drainage ditch under the following conditions:

1. *Drainage area is equal to or less than 20 ac.*
2. *Ditch slope is less than 2%.*
3. *Design velocity of flow in the ditch is less than the allowable velocity for the soil as defined in NEH Part 650, Engineering Field Handbook, Chapter 14, Drainage.*
4. *Ditch design depth is less than 2 ft.*
5. *The downstream slope of the channel block will be 5:1 or flatter. The upstream slope will be 3:1 minimum. Excavation within the ditch, upstream of the channel block, may be necessary to provide for the minimum depths of water necessary to manage the area for waterfowl.*
6. *Soil depth and texture in excavated areas are adequate for impounding water without excess seepage losses.*
7. *The top of the earthfill channel block will be no higher than the design depth of the ditch, will be level from side to side and will slope from the upstream end to the downstream end at the same slope as the ditch bottom. The length (topwidth) of the channel block will vary from 50 ft. for soils with hydraulic conductivity <0.6 in./hr. to 150 ft. for soils with hydraulic conductivity > 2.0 in./hr.*
8. *Earthfill requirements will be the same as Class IV Earth Embankments in WV Standard 377.*

Subsurface Drainage Systems:

In areas where subsurface drains were used to remove surface water or soil saturation, the existing system will be destroyed or modified to restore the wetland hydrology.

The effects of subsurface drainage systems may be eliminated by removing a portion of the drain, modifying the drain by installing a water control device, or by installing non-perforated pipe through the wetland.

The minimum length of drain to be removed will be in accordance with the requirements of NEH part 650, Engineering Field Handbook, Chapter 13, Wetland Restoration, Enhancement or Creation. Pipe removal will be at the outlet of the drainage system, or just downstream of the wetland when a portion of the drainage system downstream of the wetland is to be maintained. All envelope material, filter material or other flow enhancing material will also be removed. The trench will be filled and compacted to achieve a density equal to adjacent material.

If a portion of the drainage system upstream of the site is to be maintained then the pipe through the site will be replaced with watertight pipe for a distance that will eliminate the effect of the system on the wetland. Relocation of the drainage system around the wetland is also acceptable provided the drain can be located at a distance where it will not affect the wetland.

If a portion of a drainage system is to be maintained downstream of the site, then a surface inlet or other water control device will be installed to retain the capacity of the system. Inflow will be limited to the design capacity of the portion of the system that will be eliminated. The surface inlet or other water control device may be installed just downstream of the edge of the wetland if it is installed with watertight connections and non-perforated pipe for the minimum distances specified above for drain removal.

Criteria for Vegetative Restoration

General

Wetland plant communities may be established through natural succession or by planting. Unless high levels of maintenance are planned for the wetland, natural succession should be utilized to the extent possible. Natural succession is generally always the best option for restoring hydrophytic vegetation in West Virginia.

Where natural colonization of pre-identified, selected species will realistically dominate

within 5 years, sites may be left to revegetate naturally. If a site has not become dominated by the targeted species within 5 years, active forms of revegetation may be required.

The vegetation shall be restored as close to the original natural plant community as the restored site conditions will allow. Determination of the original plant community's species and percent composition shall be based upon reference wetlands of the type being restored ***or adjacent similar communities.***

Adequate substrate material and site preparation necessary for proper establishment ***or natural colonization*** of the selected plant species shall be included in the design.

Species of vegetation to be established will be compatible with the restored functions and hydrologic conditions of the wetland. Where wildlife habitat is identified as a primary function, refer to the WV Conservation Practice Standard Wildlife Wetland Habitat Management (644).

Vegetative Planting Criteria

Natural regeneration is the preferred method of vegetative establishment.

If the conditions do not permit the use of natural succession, or the encouragement of certain species is desired, planting of herbaceous and/or woody species may be required. Planting may also be necessary where the potential for noxious or invasive weeds to dominate the site exist.

NOTE: No variety of tall fescue or reed canarygrass shall be utilized in conjunction with this standard. The species of vegetation utilized shall not compromise wildlife functions and values.

Hydrophytic vegetation restoration shall be of species typical for the wetland type(s) being established. Preference shall be given to native wetland plants with localized genetic material.

The planned plant species will be tolerant of any nutrient, pesticide, mine drainage or other chemical loading, where such loading cannot be corrected.

Seeding rates ***to the extent practical*** shall be based upon percentage of pure live seed that shall be tested within 6 months of planting.

For species selection refer to the MidWestern & Northeast Wetland Flora, Field Office Guides to Plant Species for a list of native species suitable for planting.

NORTHEAST:

<http://www.npwrc.usgs.gov/resource/1999/neflor/neflor.htm>

MIDWESTERN:

<http://www.npwrc.usgs.gov/resource/1999/neflor/neflor.htm>

Herbaceous Settings

Where the dominant vegetation will be herbaceous community types, a subset of the original vegetative community shall be established within 5 years; or, a suitable precursor to the original community will be established within 5 years that creates conditions suitable for the establishment of the native community.

The minimum number of native species to be established shall be based upon the number of wetland types (Cowardin, et. al.) present. Sites restored to only one wetland type shall be established with at least three species adapted to the site. Sites with two or more wetland types (i.e. emergent marsh/wet meadow complex wetlands) shall be established with at least two native species on each type.

Herbaceous vegetation may be established by a variety of methods including: mechanical or aerial seeding, topsoiling, organic mat placement, wetland sod, vegetative sprigs, wetland hay, etc., over the entire site or a portion of the site and at densities and depths appropriate. Planting rates shall be compatible with the functions of the restored wetland. Refer to WV Conservation Practice Standard Critical Area Planting (342) for additional information.

Woodland Settings

Where the dominant vegetation will be forest or woodland community types, vegetation establishment will include a minimum of six

species. ***Three of which must be woody.***
NOTE: Some wetland types may have less than six naturally occurring species or less than 3 species which are woody. Contact the state staff biologist for species planting guidelines.

Tree (and shrub) planting will follow the criteria of WV Conservation Practice Standard Tree /Shrub Establishment (612). The NRCS staff biologist and/or forester may be contacted to determine site-specific tree and shrub species.

Planting rates shall be compatible with the functions of the restored wetland.

CONSIDERATIONS

On sites where woody vegetation will dominate, consider adding 1 to 2 dead snags, tree stumps or logs per acre to provide structure and cover for wildlife and a carbon source for food chain support.

Consider the impact that water surface draw-downs will have on concentrating aquatic species (such as turtles) into diminished pool area resulting in increased mortality.

Consider existing wetland functions and/or values that may be adversely impacted.

Consider the effect restoration will have on disease vectors such as mosquitoes.

Consider establishing vegetative buffers on surrounding uplands to reduce sediment and soluble and sediment-attached substance carried by runoff.

Consider the effects of soil disturbance and probability of invasion by unwanted species.

For discharge wetlands, consider underground upslope water and/or groundwater source availability.

Consider microtopography and hydroperiod when determining which species to plant.

Consider controlling water levels to prevent oxidation of organic soils and inundated organic matter and materials.

Consider effect of volumes and rates of runoff, infiltration, evaporation and transpiration on the water budget.

Consider effects on downstream flows or aquifers that would affect other water uses or users.

Consider effects on wetlands or water-related resources and wildlife habitats that would be associated with the practice.

Consider linking wetlands by corridors wherever appropriate to enhance the wetland's use and colonization by the native flora and fauna.

Consider the effects of varying water levels in response to potential climatic events such as wet or dry periods.

Consider effects of temperature on water resources to prevent undesired effects on aquatic and wildlife communities.

Consider the appearance of the restored wetland in areas of high visibility and those areas associated with recreation. The shape and form of graded areas, excavations and fills as well as the planned plant community should relate visually to the surrounding area.

Consider as a high priority those sites adjacent to existing wetlands as they increase wetland system complexity and diversity, decrease habitat fragmentation, and ensure colonization of the site by wetland flora and fauna.

Consider the effects of adjacent land uses.

Consider effects on the rate or volume of downstream flow to minimize or prohibit environmental, social or economic effects.

Consider short-term effects by restoration activities on water quality and wildlife resources.

Consider the effects on restoration by wetland dependent animals such as beaver and muskrat especially where structures are created..

Consider using restoration of degraded wetlands to enhance threatened or endangered species habitat.

Consider the effects of deer browse when establishing vegetation.

Consider the use of multiple and fluctuating water levels to establish the desired plant communities.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other documentation. Requirements for the operation and maintenance of the practice shall be incorporated into site specifications. Plans and specifications should be reviewed by staff with appropriate training in design and implementation of wetland restoration.

At a minimum the following will be identified as appropriate:

- ***Identify the restoration type (hydrologic, vegetative, or soil) and for vegetative restoration indicate whether woody or herbaceous is required;***
- ***Plan map with appropriate on-site resources identified (i.e. soils, planned structures, existing and planned vegetative communities, reference sites, etc.) Also, any off-site concern identified as impacting restoration.***
- ***Number and type of wetlands to be restored (Cowardin classification);***
- ***Wetland functions planned for restoration;***
- ***Any component practices required to restore the wetland;***
- ***Existing water table depths or indicators of seasonal high water tables and planned restoration depths;***

- **Type of manipulation that caused restoration to be required**
- **Soil type(s) and amounts within the project area shown at an appropriate scale;**
- **For herbaceous vegetative restoration, indicate the stock type, planting date, spacing, rates and planting depths**
- **Existence, location (and/or elevation if necessary) of neighboring property boundaries and utilities;**
- **Presence, types and extent of all artificial drainage measures;**
- **Documentation of required permits and any environmental evaluation required including the WVCPA-052 or similar document; and**
- **Any structural specification that is developed for individual components of the wetland system design using specifications or guides attached to the WV standards, NEH 20 or FOTG-Section IV "700 series" specifications.**

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance):

An operation and management plan shall be developed for all installations. The operation and management plan shall be provided to and discussed with the operator and documented in the assistance notes or similar format..

Items that should be addressed in the plan as applicable are:

- ***The operation and maintenance plans for any individual structures and/or component practices necessary to restore the wetland or maintain desired***

hydrologic conditions [e.g. Shallow Water Development/Management, (646)];

- ***An inspection schedule of components, embankments and structures for damage assessment;***
- ***The depth of sediment accumulation before removal is required and methods of removal;***
- ***Any required maintenance of vegetation (e.g. nutrient management, reseeding, or similar practices) and if necessary a plant restoration plan.*** Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals shall assure that the intended purpose of the wetland restoration shall not be compromised;
- ***Any management techniques to control noxious or invasive species.*** Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) shall be implemented where available and feasible. The control of water depth and duration may be utilized to control unwanted vegetation.
- ***Any acceptable uses including the timing and intensities (e.g. grazing, haying, timber removal).*** For wildlife habitat purposes, haying and grazing, if justified as a necessary wildlife/wetland management tool, may be used for management of vegetation. Disturbance to ground nesting species shall be minimized ***(April 15-July 15). If utilizing grazing as a management tool, the timing and intensity shall be specified. Refer to WV Conservation Practice Standard Prescribed Grazing (528) for more information.***

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****Bold italics indicate changes made or information added to the National standard by West Virginia.***